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The Use of Beam Propagation Modeling of Beamlet and Nova to Ensure a "Safe" NIF Laser System Design*

M.A. Henesian, J.M. Auerbach, S.W. Haney,
J.T. Hunt, J.K. Lawson, K.R. Manes, D. Milam, C.D. Orth, P.A. Renard,
R.A. Sacks, D.R. Speck, J.B. Trenholme, C.C. Widmayer, and W.H. Williams

Lawrence Livermore National Laboratory
P.O. Box 808, L-490
Livermore, CA 94550 USA
(510) 423-1504/FAX (510) 423-6506

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Abstract

Computer codes that model the propagation of intense laser beams through laser systems have played key roles in the design and analysis of all the Inertial Confinement Fusion Lasers built at the Lawrence Livermore National Laboratory (LLNL). These codes treat, at various levels of sophistication, the effects of linear diffraction, loss, amplification, beam perturbation by self-focusing. It is important that these codes be validated, because staging and architecture decisions (which often involve significant cost consequences) are driven by risk-of-damage assessments made using them. Over the past year, LLNL's propagation codes have been benchmarked against analytical propagation cases, nonlinear perturbation analyses, earlier-generation laser propagation codes, and most importantly, against the results of specially designed experiments. This paper describes comparisons of the codes with results of self-focusing experiments conducted in the Optical Science Laser (OSL) Facility, Beamlet, and Nova Lasers. With no adjustable or fitting parameters, we simulated on OSL 1ω pseudoscopic image formation with good accuracy. We also successfully modeled the onset of filamentation tracking in bulk SiO_2. But most importantly, we successfully used these validated codes to predict the beam properties of the Nova and Beamlet laser systems. The results of these system calculations, their comparison with the test data and how they are used in the NIF design will be discussed.

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